Accurate Measurement of the Sliding Distance of a Lag Screw Using 3D Reconstruction Modeling

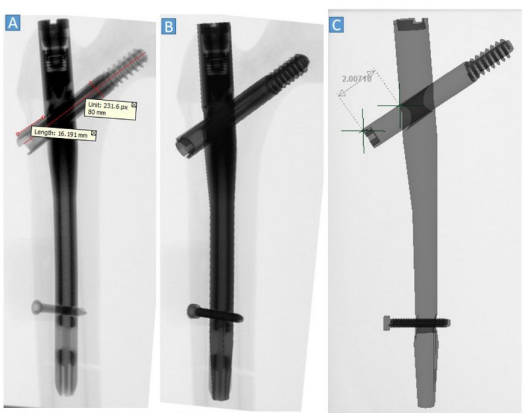
***Xuan Lin Zheng**; Young-Chang Park; Kyu-Hyun Yang*
Department of Orthopedics Surgery, Yonsei University, College of Medicine, Gangnam Severance Hospital, Seoul, SOUTH KOREA

Purpose: Cephalomedullary nailing (lag screw system) has become a popular treatment for unstable intertrochanteric fractures. Sliding distance is usually measured using a standard AP hip radiograph. However, it is frequently taken with the limb in external rotation and/or flexion of the lower limb and that causes inaccurate measurement of the sliding distance (SD) of a lag screw. Here, we developed a new 3-dimensional (3D) reconstruction modeling method to make an accurate measurement of the SD of a lag screw, and then we evaluated the accuracy of this new method by comparing the conventional method with it.

Methods: Radiographs of Sawbones implanted with a 125° cephalomedullary nail were taken in 90 different postures: neutral, internal rotation/external rotation (0~60), flexion/extension (0~50), extension (5~20), and internal rotation (0~50). Then 3 orthopaedic surgeons measured SD using both traditional method and 3D method (Fig. 1).

Results: The measurement values by 3D method were close to the actual length regardless of the limb posture, with even less standard deviation. The SD was high when using the traditional method, especially when the nail (lower limb) rotates. The Pearson correlation coefficient showed positive correlation ($P < 0.001$) of the measurement values with variation of the C-arm positions when using the traditional method.

Conclusion: We conclude the traditional method of measuring SD is not accurate when the lower limb is rotated and/or flexed, while the 3D method is accurate in measuring the sliding distance of a lag screw regardless of the postures of the lower limb.



This is the Anteroposterior radiogram when the C-arm is external rotated by 40 degrees and the actual sliding length is 20mm
A: The sliding length is 16.191 mm by using the traditional method.
B: In MAYA scenograph view, 3D reconstruction model is changed X-ray mode which will completely match the nail image in the radiogram through spatial
Movement and lag screw's sliding.
C: The sliding distance of the lag screw will be measured on the coronal view of MAYA, the measurement value is 20.071mm

See pages 401 - 442 for financial disclosure information.